IN THE CLAIMS:

1. (Currently Amended) ~~In a file server having a storage operating system, a~~A method for managing storage of data in a plurality of storage devices operatively connected to a computer, each storage device having a plurality of blocks for storing data, comprising:

generating block layout information ~~in a file system layer of a~~the storage operating system executing on the computer by determining which blocks within the plurality of blocks are allocated for storing data and which are unallocated;

~~transferring the block layout information from the file system layer to a RAID layer of the storage operating system;~~

responsive to the block layout information, controlling execution of I/O operations generated by the storage operating system~~at the RAID layer~~ by identifying a plurality of contiguous blocks ~~on a single storage device~~within the plurality of blocks for use by the~~each~~ I/O operations so as to substantially maximize chain lengths of read operations for calculation of parity;

determining whether a parity subtraction method or a recalculation method requires a fewest number of read operations to calculate parity for the I/O operations;

selecting the parity subtraction method or the recalculation method for parity calculation based on which method requires the fewest number of read operations; and

responsive to the block layout information and the parity calculation method selected, identifying the contiguous blocks within the plurality of blocks for use by the I/O operations.

2. (Currently Amended) A method for managing storage of data in a plurality of storage devices operatively connected to a computer, each storage device comprising a plurality of storage blocks, comprising:

generating block layout information of a storage operating system executing on the computer by determining which blocks within the plurality of storage blocks are allocated for storing data and which are unallocated;

7   determining whether a first methodology or a second methodology requires a

8   fewest number of read operations to calculate parity for I/O operations generated by the

9   storage operating system; and

10   in response to the block layout information and the determination, controlling

11   execution of I/O operations by identifying a plurality of contiguous storage blocks of the

12   plurality of storage blockson a single storage device for use by theeach I/O operations so

13   as to substantially minimize athe number of read operations needed for calculation of

14   error correction parameters across a stripe disposed among the plurality of storage

15   devices.

1   3. (Original) The method of claim 2 wherein the calculation of error correction

2   parameters comprises the calculation of parity.

1   4. (Currently Amended) The method of claim 2 wherein the calculation of parity

2   comprises selecting a parity calculation operation from a group consisting of a

3   subtraction method isas the first methodology and a parity re-calculation method isas the

4   second methodology.

1   5. (Currently Amended) The method of claim 2 wherein the identification of the plurality

2   of contiguous storage blocks for use byin the I/O operationssubstantially maximizes a

3   chain length by substantially maximizing a number of blocks of the plurality of storage

4   blocks having a contiguous physical layout on the a firstsingle storage device of the

5   plurality of storage devices.

1   6. (Currently Amended) The method of claim 2, further comprising:

2   identifying the plurality of the contiguous storage blocks for use byin the I/O

3   operations so as to substantially maximize athe chain length by substantially maximizing

4   a number of blocks of the plurality of storage blocks having sequential volume block

5   numbers (VBNs) associated with the plurality of storage blocks.

7. (Currently Amended) The method of claim 2, further comprising:

identifying the <u>plurality of the</u> contiguous storage blocks for use by~~in~~ the I/O operations so as to ~~substantially~~ maximize a~~the~~ chain length by ~~substantially~~ maximizing locality of the <u>plurality of</u> contiguous blocks of a~~the~~ <u>first</u>~~single~~ storage device <u>of the plurality of storage devices</u>.

8. (Currently Amended) The method of claim 2 wherein controlling execution comprises:

examining <u>the plurality of</u> storage blocks to which data is to be written ~~prior to write operations~~; and

selecting either,

the first methodology comprising minimizing a number of blocks read, or

the second methodology comprising maximizing chain lengths of blocks read for calculating parity.

9. (Currently Amended) The method of claim 8, wherein controlling execution further comprises:

implementing <u>the</u> selection of the <u>first or second</u>~~parity calculation~~ methodology responsive to the block layout information;

wherein, if the <u>first methodology is selected</u>~~selection constitutes minimizing the number of blocks read~~,

determining on a stripe-by-stripe basis whether to calculate parity based on a subtraction method or a recalculation method,

performing <u>a number of</u>~~any appropriate~~ read operations <u>of the plurality of storage blocks</u>~~to support the method selected~~, and

calculating parity responsive to the number of blocks read and the data to be written; and

wherein, if the <u>second methodology is selected</u>~~selection constitutes maximizing chain lengths of blocks read~~,

deciding which storage blocks to read to maximize chain length while minimizing the number of blocks read to support either the subtraction method or the recalculation

17   method,

18   performing read operations on the number of blocks read, and

19   calculating parity responsive to the number of blocks read and the data to be

20   written.

1   10. (Currently Amended) The method of claim 2, wherein identifying the contiguous

2   storage blocks is based at least in part on an available resource of the computer.

1   11. (Currently Amended) The method of claim 2 further comprising transmitting the

2   block layout information from a file system layer of the computer to a RAID layer of the

3   computer.

1   12. (Currently Amended) The method of claim 2 wherein generating further comprises:

2   making a first determination as to whether a storage block of the plurality of

3   storage blocks is unallocated;

4   making a second determination as to a current implementation of the plurality of

5   storage devices; and

6   generating the block layout information based at least in part on the first and the

7   second determinations.

1   13. (Currently Amended) The method of claim 2, wherein ~~the I/O operation is one of a~~

2   ~~plurality of I/O operations and~~ at least one of the ~~plurality of~~ I/O operations ~~is~~ comprises

3   a read operation.

1   14. (Previously Presented) The method of claim 5, wherein the chain length is a length of

2   a read operation for calculation of parity.

1   15. (Previously Presented) The method of claim 5, wherein the chain length is a length

2   for a write operation for the data.

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16. (Currently Amended) A method for managing storage of data in a storage system,
comprising:

maintaining a plurality of storage devices of the storage system, each storage
device having a plurality of storage blocks; and

writing data to predetermined storage blocks of the plurality of storage blocks
across a plurality of stripes and to predetermined contiguous storage blocks within the
plurality of each storage devices so as to maximize chain lengths of the predetermined
contiguous storage blocks within each storage device and minimizing a number of read
operations for the calculation of error correction parameters across each stripe of the
plurality of stripes by determining whether a parity subtraction method or a recalculation
method requires a fewest number of read operations to calculate parity, and selecting the
parity subtraction method or the recalculation method for parity calculation based on
which method requires the fewest number of read operations.

17. - 38. (Cancelled)

39. (Currently Amended) A storage system, comprising:

a storage adapter configured to couple the storage system to a plurality of storage
devices, each storage device having a plurality of storage blocks; and

a storage manager in communication with the plurality of storage devices, the
storage manager configured to write data to predetermined storage blocks of the plurality
of storage blocks across a plurality of stripes and to predetermined storage blocks within
the plurality of each storage devices so as to substantially maximize a chain length of the
plurality of storage blocks by selecting as many contiguous storage blocks within a
first single storage device of the plurality of storage devices while minimizing a number
of read operations required for calculation of error correction parameters across each
stripe of the plurality of stripes by determining whether a parity subtraction method or a
recalculation method requires a fewest number of read operations to calculate parity and
selecting the parity subtraction method or the recalculation method for parity calculation
based on which method requires the fewest number of read operations.

40. (Currently Amended) A system for managing ~~the~~ data storage ~~of data~~, comprising:

a plurality of storage devices operatively connected to a computer, each storage device having a plurality of storage blocks;

a storage device manager of the computer in communication with the plurality of storage blocks;

a block layout information generator of the computer in communication with the storage device manager and the plurality of storage blocks; and

an error correction parameter calculator of the computer in communication with the plurality of storage blocks and the storage device manager,

wherein the storage device manager, in response to ~~the~~ block layout information from the block layout information generator, controls execution of an I/O operation by identifying a plurality of contiguous storage blocks on one or more ~~a single~~ storage devices of the plurality of storage devices for use by the I/O operation so as to maximize a chain length within the one or more ~~single~~ storage devices while minimizing a number of read operations required ~~for calculation~~ by the error correction parameter calculator to calculate ~~of~~ error correction parameters across a stripe of the one or more storage devices by determining whether a parity subtraction method or a recalculation method requires a fewest number of read operations to calculate parity for the I/O operations and to selecting the parity subtraction method or the recalculation method for parity calculation based on which method requires the fewest number of read operations.

41 - 44. (Cancelled)

45. (Currently Amended) A method for managing storage of data by a ~~server~~computer, comprising:

receiving a request to write the data to a plurality of storage devices connected to the computer;

generating block layout information to determine which blocks within a plurality of blocks ~~located in~~of the plurality of storage devices are allocated and which are unallocated;

7

8 identifying <u>one or more</u> blocks of<s>within</s> the plurality of blocks <u>from the block</u>

9 <u>layout information</u> for use by a set of I/O operations;

10 determining a <u>first</u> number of read operations needed to calculate parity for the

11 data by calculating parity using a subtraction method;

12 determining a <u>second</u> number of read operations needed to calculate parity for the

13 data by calculating <u>the</u> parity using a recalculation method;

14 <s>choosing either the subtraction method of calculating parity or the recalculation</s>

15 <s>method of calculating parity by</s> determining which method requires a fewer number of

16 read operations, and choosing the <s>which</s> method that requires the fewer number of read

17 operations; and

18 writing the data to the identified <u>one or more</u> blocks, and calculating <u>the</u> parity for

19 the data using the <s>which</s> <u>chosen</u> method.

1 46. (Currently Amended) The method of claim 45, further comprising:

2 choosing to either maximize chain lengths <s>of read operations</s> for calculating<u>the</u>

3 parity or choosing to place the data with a high degree of locality in the plurality of

4 storage devices <u>for calculating the parity</u><s>, by choosing the which method that requires the</s>

5 <s>fewer number of read operations</s>.

1 47. (Currently Amended) A method for managing storage of data by a <s>server</s><u>computer</u>,

2 comprising:

3 receiving a request to write data to a plurality of storage devices <u>operatively</u>

4 <u>connected to the computer</u>;

5 generating block layout information to determine which blocks within a plurality

6 of blocks of<s>located in</s> the plurality of storage devices are allocated and which are

7 unallocated;

8 identifying <u>the unallocated</u> blocks <s>within plurality of blocks</s> for use by a set of

9 I/O operations to store the data; <s>and</s>

10 determining, in response to the block layout information, whether <u>a first method</u>

11 to minimize a number of read blocks or whether <u>a second method</u> to maximize chain

12 lengths of read blocks ~~based on which method~~ requires a fewer number of read

13 operations, and

14 selecting~~implementing a selection~~ one of the first method and the second method

15 that requires the fewer number of read operations responsive to the determining and

16 responsive to the block layout information, and~~during the~~ writing ~~of~~ the data to the

17 plurality of storage devices using the selected method~~, responsive to the block layout~~

18 ~~information, and responsive to whether minimizing the number of read blocks or~~

19 ~~substantially maximizing chain lengths of read blocks requires the fewer number of read~~

20 ~~operations~~.

1 48. (Currently Amended) The method of claim 47, further comprising:

2 in response to selecting the first method~~to minimize the number of read blocks~~,

3 determining whether a subtraction method to calculate parity~~based on a subtraction~~

4 ~~method~~ or whether a recalculation method to calculate the parity~~based on which method~~

5 requires the fewer number of read operations; and

6 performing the write operation and calculating the parity using one of the

7 subtraction method and the recalculation method that~~which parity calculation method~~

8 requires the fewer number of read operations.

1 49. (Currently Amended) The method of claim 47, further comprising:

2 in response to selecting the second method~~to maximize chain lengths of read~~

3 ~~blocks~~, deciding which storage blocks to read to maximize chain lengths while

4 minimizing the number of storage blocks read to support one of a~~either the~~ subtraction

5 method to calculate parity and~~or the~~ a recalculation method to calculate the parity; and

6 performing the write operation and calculating the parity using one of the

7 subtraction method and the recalculation method~~which parity calculation method~~ that

8 requires the fewer number of read operations.

1 50. (Currently Amended) A method for managing storage of data by a ~~server~~computer,

2 comprising:

3   receiving a request to write data to a plurality of storage devices <u>operatively</u>

4   <u>connected to the computer</u>;

5   generating block layout information to determine which blocks within a plurality

6   of blocks ~~located in~~<u>of</u> the plurality of storage devices are allocated and which are

7   unallocated;

8   identifying <u>one or more unallocated</u> blocks ~~within the plurality of blocks~~ for use

9   by a set of I/O operations to store the data;

10   testing to either maximize chain lengths of read operations for calculation of

11   parity, or <u>testing</u> to place the data with a high degree of locality in the plurality of storage

12   devices, the testing comprising,

13   determining, for both maximizing chain length<u>s</u> and placing the data with the high

14   degree of locality, a number of read operations needed to calculate parity for the data, by

15   calculating parity using both a subtraction method of calculating parity and a

16   recalculation method of calculating parity;

17   first choosing to either maximize chain lengths of read operations for calculation

18   of parity or to place the data with the high degree of locality in the plurality of storage

19   devices, and after the first choice, secondly choosing either the subtraction method of

20   calculating parity or the recalculation method of calculating parity by determining which

21   of these methods requires a fewest number of read operations,

22   choosing <u>the method</u> which ~~method~~ requires the fewest number of read operations

23   of calculating parity of the data; and

24   writing the data to the identified blocks, and calculating parity for the data using

25   the <u>chosen</u>~~which~~ method.

1   51. (Currently Amended) A computer-readable media, comprising:

2   said computer readable media containing instructions for execution on a processor

3   for a method of managing storage of data in a plurality of storage devices, each storage

4   device having a plurality of blocks for storing data, the method comprising,

5   generating block layout information; and

6   in response to the block layout information, controlling execution of an I/O

7   operation to the plurality of storage devices by identifying a plurality of contiguous

8   storage blocks on the plurality of a single storage devices for use by the I/O operation so

9   as to minimize a number of read operations needed for calculation of error correction

10   parameters across a stripe of the plurality of storage devices by determining whether a

11   parity subtraction method or a recalculation method requires a fewest number of read

12   operations to calculate parity for the I/O operations and selecting one of the parity

13   subtraction method and or the recalculation method for parity calculation based on which

14   method requires the fewest number of read operations.